

- 1 1. An integrated miniaturized system for chemical analysis of fluids, comprising:
2 an electrospray substrate having an injection side and an ejection surface, the
3 substrate defining an entrance orifice on the injection side, a nozzle on the ejection
4 surface, a channel extending between the entrance orifice and the nozzle, and a
5 region surrounding the nozzle recessed from the ejection surface; and
6 electrode means for providing electrical contact to the fluids.
- 7 2. The system of claim 1, wherein said electrode means comprises an external
8 conductor in contact with the fluid prior to said injection side.
- 9 3. The system of claim 1, wherein the channel has a cross-sectional area less than
10 approximately 50,000 μm^2 .
- 11 4. The system of claim 1, wherein the substrate defines a plurality of entrance
12 orifices on the injection side, a plurality of nozzles on the ejection surface each
13 corresponding to one of the plurality of entrance orifices, a plurality of channels each
14 extending between one of the plurality of nozzles and the corresponding one of the plurality
15 of entrance orifices.
- 16 5. The system of claim 4, wherein an array of said plurality of nozzles are radially
17 positioned on the ejection surface of the electrospray substrate.
- 18 6. The system of claim 1, further comprising a device in fluid communication with
19 the entrance orifice.
- 20 7. The system of claim 1, wherein an array of nozzles are defined on the ejection
21 surface of the electrospray substrate, and further comprising a daughter plate defining a
22 plurality of receiving wells positioned to receive a fluid ejected through the nozzles of the
23 electrospray substrate.
- 24 8. The system of claim 1, further comprising a second substrate defining an
25 entrance opening on a first surface and an exit on a second surface, the second substrate
26 being bonded to the electrospray substrate such that the second substrate exit is in fluid
 communication with the electrospray substrate entrance orifice.
9. The system of claim 1, further comprising a second substrate defining an
 entrance opening on a first surface, an exit on a second surface, a fluid reservoir recessed
 from the second surface, a separation channel recessed from the second surface, the
 separation channel including the exit and extending between the reservoir and the exit, an
 introduction channel extending between the entrance opening and the reservoir, and a
 plurality of posts extending from the separation channel, wherein the second substrate is
 bonded to the electrospray substrate to enclose the reservoir and the separation channel

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adjacent the ~~electrospray~~ substrate and such that the second substrate exit is in fluid communication with the electro~~spray~~ substrate entrance orifice.

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- 1 11. A method for generating an electrospray of a fluid, comprising:
2 providing a channel extending between an entrance orifice defined on an
3 injection surface of a substrate and a nozzle defined on an ejection surface of the
4 substrate;
5 introducing a fluid into the channel through the entrance orifice;
6 providing a first electrode in electrical contact with the fluid;
7 applying a first potential voltage to the fluid;
8 positioning the nozzle adjacent to an extracting electrode; and
9 ejecting the fluid from the channel through the nozzle by applying or holding
10 the extracting electrode at a second potential voltage different from the first
11 potential voltage.
12 12. The method of claim 11, further comprising:
13 providing a second electrode in electrical contact with the substrate; and
14 applying a third potential voltage to said second electrode, different from said
15 first potential voltage.
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1 13. A liquid chromatography system, comprising:

2 a first substrate having a first surface and a second surface, the first substrate
3 defining an entrance opening on the first surface, a fluid reservoir recessed from the
4 second surface, a first channel extending between the entrance opening and the
5 reservoir, a second channel recessed from the second surface, and a plurality of
posts extending from the second channel; and

6 a cover substrate bonded to the first substrate to enclose the reservoir and the
7 second channel adjacent the cover substrate,

8 wherein the first and/or the cover substrate defines an exit and wherein the
9 second channel extends between the exit and the reservoir.

10 14. The liquid chromatography system of claim 13, further comprising an
insulating layer provided over the surfaces of the separation channel and the plurality of
posts.

11 15. The liquid chromatography system of claim 13, wherein the posts are spaced
12 apart from each other by no more than 5 μm .

13 16. The liquid chromatography system of claim 13, wherein the first substrate
14 defines a plurality of entrance openings on the first surface, a plurality of reservoirs recessed
15 from the second surface each corresponding to one of the plurality of entrance openings, one
16 or more first channels each corresponding to and extending between one of the plurality of
17 entrance openings and the corresponding reservoir, and a plurality of second channels
18 recessed from the second surface, wherein the first and/or the cover substrate defines a
19 plurality of exits each corresponding to one of the plurality of reservoirs, and wherein each
20 second channel corresponds to and extends between one of the plurality of reservoirs and the
21 corresponding exit.
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20. The system of claim 18, wherein a plurality of liquid chromatography systems are each integrated in said second substrate, and each configured to receive a fluid for analysis and to process and output the fluid; and a plurality of electrospray devices, each integrated on said first substrate, the electrospray devices each having an injection surface configured to receive the processed fluid from the liquid chromatography system, and each having an ejection surface configured to dispense the fluid by electrospraying the fluid.

1 21. A system comprising:

2 a microfabricated device defining a liquid chromatography device comprising
3 an entrance for receiving an analyte, the device further defining an electrospray
4 device including a nozzle, the electrospray device being configured to receive the
5 analyte from the liquid chromatography device and to generate an electrospray; and

6 a mass spectrometer comprising a sampling orifice, said microfabricated
7 device being positioned to eject the electrospray from the nozzle into the sampling
8 orifice.
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22. A method of mass spectrometric analysis utilizing an integrated chemical analysis device comprising:

a first microfabricated structure defining a liquid chromatography device comprising an entrance for receiving an analyte and an exit; and

a second microfabricated structure defining an electrospray device including an entrance for receiving the analyte from the liquid chromatography device and a nozzle in fluid communication with the entrance, the electrospray device to generate an electrospray and wherein the electrospray nozzle is adapted to eject the electrospray from the nozzle into a sampling orifice of a mass spectrometer.